REMARKS/ARGUMENTS

Reconsideration and allowance of this application are respectfully requested. Currently, claims 9-10, 12-15, 19-29, 31-33 and 35-37 are pending in this application.

Rejection Under 35 U.S.C. §103:

Claims 9-10, 17-18, 26-29 and 31-33 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over the three-way combination of Gupta (U.S. '359) and Bona (U.S. '049) and further in view of Glebov (U.S. '508). Applicant traverses this rejection.

In order to establish a *prima facie* case of obviousness, all the claim limitations must be taught or suggested by the prior art. The combination of Gupta, Bona and Glebov fails to teach or suggest all the claim limitations. For example, the combination fails to teach or suggest first and second optical components, the first optical component having a substrate and one or more layers defining an optical confinement region, wherein the first optical component has a bonding surface and is flip chip mounted on a shared substrate and further comprises a spacing layer comprising a glass material having both organic and inorganic components, as required by independent claim 9 and its dependents. Similar (but not necessarily identical) comments apply to independent claim 28.

Independent claims 9 and 28 require the use of a spacing layer as an additional part of an optical component for flip chip mounting. However, the spacing layer does not play an optical role *per se* in the optical component. It is used in addition to the layer(s) providing optical confinement. For example, the optical component of claim 9 requires a spacing layer in addition to the layer(s) which define an optical confinement region. The spacing layer comprises in particular a (hybrid) glass material having both organic and inorganic components.

None of the cited references (Gupta and Bona and further in view of Glebov) teaches or suggests the use of a spacing layer added to an optical component rather than to a substrate and none of the cited references teaches or suggests the use of a hybrid glass material having both organic and inorganic components solely as a spacing layer. Accordingly, even if the disclosures of Gupta, Bona and Glebov were combined as proposed by the Office Action, the combination of these disclosures would not have taught or suggested all of the claim limitations.

It is agreed that if a component is going to be flip chip mounted into alignment with another component, then each layer of the component that contributes to its position in the finished assembly has a role in spacing. However, all of the cited prior art shows arrangements in which the dimensions of a component and the substrate onto which it is going to be mounted are tailor-made to achieve alignment. Although the thickness of the various layers inevitably provides spacing, there is no recognition or suggestion in Gupta, Bona or Glebov of an arrangement for adjusting the dimensions of an existing device, that is a device that already provides optical confinement, by adding a layer for spacing, nor is there the particular recognition that a hybrid glass material having both organic and inorganic components is very well suited to the role. The only use of a hybrid glass material at all is disclosed in Glebov, for its optical properties as a cladding layer <u>in constructing an optical confinement region</u> of a waveguide.

In this respect, Applicant recognizes the Office Action's contention that Glebov also discloses hybrid glass for use as a substrate in column 4 but notes that the <u>only</u> possibly relevant material mentioned in column 4 is glass plate. A hybrid glass is a very special form of glass which is later quoted in column 6 of Glebov as an <u>alternative</u> to glass material, for use as a cladding layer. This passage in column 6 reads:

> *"The waveguides or cores may be manufactured of any suitable material. For example, the waveguides may be formed using a highly transparent, highly heat-resistant polymer such as a fluorinated polyimide, or quartz or another glass or polymer material. The same type of material may also be used for the cladding layers, or an organic and/or inorganic hybrid may be used."* (Emphasis added)

For the sake of accuracy, the organic/inorganic hybrid glass material is clearly mentioned in column 6 as an alternative to a glass material where the cladding layers are concerned and the disclosure in column 4 only mentions glass plate, not an organic/inorganic hybrid glass material, as an alternative alongside printed circuit board for use as a substrate.

A problem that example embodiments of the present invention solve is how to import a component for flip chip mounting into alignment on a substrate that might be pre-existing and/or already have other components mounted on it or to be flip chip mounted into alignment. The imported component is not designed for the particular application and doesn't have the necessary dimensions to come into optical alignment. The problem is solved by adding a spacing layer of hybrid glass material to the imported component. This allows components to be substituted for each other in an existing fabrication process. The significance of using the hybrid glass material is that different components have different tolerances, for example processing temperature, and the hybrid glass materials are extremely versatile. This means that a suitable hybrid glass material can be found to adjust the dimensions of a wide range of possible imported components in an opto-electronic assembly without destroying the component by adding the spacing layer.

This quite different, non-optical use of a hybrid glass material as a spacing layer alone, which can thus be used to adjust the dimensions of existing devices for flip chip mounting onto

existing substrates and into alignment with components already present on the substrate is not taught or suggested by the three-way combination of Gupta, Bona and Glebov.

For example, Glebov teaches the use of a hybrid glass material as an optical cladding layer in a planar waveguide. If one could flip chip mount the waveguide of Glebov onto a substrate, one would not arrive at the present invention because the hybrid glass material is present in the waveguide for its optical properties to provide a confinement region. There is no further layer there just for the purpose of providing spacing for alignment purposes. Glebov does indeed refer to the vertical alignment of devices on a substrate and specifies that the thicknesses of the cladding layers of the waveguide have to be chosen so that vertical alignment is achieved when other components are assembled onto the same substrate but these cladding layers are already present and have an optical role. Glebov is describing an end-to-end fabrication process and simply adjusts the thickness of the layers during fabrication so that vertical alignment is achieved. This is not possible where a pre-existing optical component is being addressed.

Gupta teaches a buffer layer on top of an etched substrate prior to flip chip mounting a device onto the substrate. The buffer layer is not provided on the optical component and is made of an oxide material, not a hybrid glass. The whole emphasis in Gupta is on etching of the substrate to provide alignment in the finished assembly. Although the buffer layer will inevitably be involved in spacing, it is applied to the substrate, not to the flip chip mounted component. A typical passage in Gupta discussing vertical alignment is as follows:

> *"The waveguide device 53 rests on semiconductor diode laser substrate. The etching is formed to a depth that maximises the light coupling to waveguide. The etching depths are on the order of microns. The waveguide is then mechanically aligned 16 the laser diode solely by lateral motion to optimize the light coupling to the waveguide.*

> *Vertical motion is already fixed by the etching.*" (Col. 4 lines 5-13).

If the buffer layer in Gupta were considered to be a spacing layer, it would not lead one of ordinary skill in the art towards the present invention in which it is the optical component to be flip chip mounted that has the spacing layer, not the substrate. The substrate in Gupta is just a single material, for example gallium arsenide, and does not have any of the more complex structure of an optical component with layers of material whose properties and interfaces determine an optical confinement region. It is these materials and interfaces which can have stringent processing requirements and thus present a significantly different problem.

Bona does not resolve the deficiencies of Gupta and/or Glebov. Bona is merely another example of an assembly where all the emphasis is on adjusting the substrate and layers grown onto the substrate to give alignment. To quote the abstract:

> *"Automatic alignment of an optical waveguide to a ridge waveguide laser is accomplished by transferring the ridge structure of the laser to a substrate by etching a mirror groove. The transferred ridge structure serves as a base for the deposition of waveguide layers. The thickness of the waveguide layers are controlled during the deposition such that the waveguide core is laterally and vertically aligned to the lasing active layer of the laser structure."*

Bona shows a complicated structure which is entirely based on etching and deposition of layers on a substrate. There is no flip chip mounting and no modification of a component that already has an optical confinement region defined.

Applicant therefore requests that the rejection under 35 U.S.C. §103 over Gupta, Bona and Glebov be withdrawn.

Claims 12-13 and 35-37 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over the four-way combination of Gupta, Bona and Glebov, and further in view of

Tada (U.S. '902). Claims 14-15 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over the four-way combination of Gupta, Bona and Glebov, and further in view of Blauvelt (U.S. '913). Claims 19-22, 24 and 25 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over the four-way combination of Gupta, Bona and Glebov, and further in view of Nashimoto (U.S. '660). Claim 23 was rejected under 35 U.S.C. §103 as allegedly being unpatentable over the five-way combination of Gupta, Bona, Glebov and Nashimoto, and further in view of Kaneko. Each of these claims depends directly or indirectly from independent claim 9 or 28 and thus the comments made above with respect to at least Gupta, Bona and Glebov apply equally to these claims. Applicant submits that none of the additionally cited references (Tada, Blauvelt, Nashimoto or Kaneko) resolve the above-described deficiencies of the three-way combination of Gupta, Bona and Glebov. Applicant therefore requests that the various rejections under 35 U.S.C. §103 be withdrawn.

Conclusion:

Applicant believes that this entire application is in condition for allowance and respectfully requests a notice to this effect. If the Examiner has any questions or believes that an interview would further prosecution of this application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

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